

LIFE SCIENCES

Paper III

Time Allowed : 2½ Hours]

[Maximum Marks : 200

Instructions :—This paper has **four (4)** sections. Each section has its own separate instructions regarding the length of the answer, the choice of questions, and the marks assigned to each question to be answered. There are totally **19** questions to be answered. Maximum marks are **200**.

SECTION I

Instructions :—In this section there are **2 (two)** questions (Q. 1 and Q. 2) to be answered each in about **500** words. Each question is assigned **20 (twenty)** marks.

1. “The amino acid sequence of a protein specifies its three-dimensional structure.” Explain with suitable examples.

Or

Describe the structure of bacterial cell wall highlighting the differences between those of Gram positive and Gram negative bacteria. Name the antibiotics affecting cell wall biosynthesis and their site of action.

Or

Describe the mechanism of symbiotic nitrogen fixation in leguminous plants.

Or

Why do certain fishes migrate ? Classify different types of horizontal migration of fishes with suitable examples and explanation.

2. Give a detailed account of biosynthesis of cholesterol and its regulation.

Or

Discuss the experimental evidences elucidating the molecular basis of antimicrobial action of streptomycin.

Or

“Fertilization in angiosperms is a far more elaborate process as compared to fertilization in bryophytes.” Justify.

Or

Give the spatial and temporal sequence of events linking acrosome reaction to cortical reaction. Explain the molecular mechanism involved in cortical reaction preparing the egg for development.

SECTION II

Instructions :—In this section there are **3 (three)** questions (Q. No. 3 to Q. No. 5), to be answered each in about **300** words. Each question is assigned **15 (fifteen)** marks.

3. How is a nerve impulse propagated at a neuromuscular junction ? How are excitation and muscle contraction coupled ?

Or

“SOS repair mechanism represents the ditch attempt by damaged cells to survive at the cost of burden of mutation.” Justify.

Or

Plants of a taxonomic species of five localities exhibit distinctly different morphologies. Which methods would you use to understand the nature and causes of variation ? Explain.

Or

How does a true coelom differ from pseudocoelom ? Justify your explanation with suitable examples from appropriate phylogenetic groups.

4. With a suitable example explain the biosynthesis and mechanism of action of any peptide hormone.

Or

Define synchronous growth of bacteria. How can bacterial growth be synchronised ? Write a note on the significance of synchronous culture in bacterial physiology.

Or

Transition from vegetative to florally induced shoot apex is accompanied by morphological, histological and physiological changes. Explain the concept with the help of a model system.

Or

Distinguish between intracellular and extracellular digestion. With reference to mammals, explain the functional roles played by pancreas and gall bladder in digestion.

5. What is the significance of blood-brain barrier ? Give the composition and function of cerebrospinal fluid.

Or

Elaborate on the recycling of cellulosic wastes for production of protein rich biomass.

Or

What are megacentres of plant diversity ? Describe them with special reference to India.

Or

Describe the causative agents for sleeping sickness with reference to its clinical consequences.

SECTION IV

Instructions :—In this section there are **5 (five)** questions (Q. No. 15 to Q. No. 19) to be answered each in about **30** words. Each question is assigned **5 (five)** marks.

15. (a) Tropomyosin, a 70-kd muscle protein, is a two stranded α -helical coiled coil. What is the length of the molecule ?
- (b) A 40-residue segment of a protein folds into a two-stranded antiparallel β -structure with a 4 residue hairpin turn. What is the dimension of this motif ?

Or

In renaturation kinetics, DNA sample is subjected to melting by heat and annealing by cooling; the process is monitored in terms of absorbance at 260 nm. Renaturation is less effective if DNA is rapidly cooled. However if the sample of DNA is treated with mitomycin, it renatures effectively even after rapid cooling. Explain the effect of mitomycin.

Or

Asparagus has XY mechanism of sex. *In vitro* anther culture was done and haploid plants were obtained and then diploidised.

- (a) What will be the genotype of the progeny ?
- (b) If there are more than one genotypes mention them.
- (c) State the proportion in which genotypes are represented.
- (d) Are suppermales expected ?
- (e) What will be the proportion of male and female plants ?

Or

Individuals of a population suffering from a common ailment were being treated with 5 mg of drug X. Whereas the symptoms subsided in most of the individuals, there were a few in whom the symptoms persisted without any effect. However, the symptoms came under control when these individuals were treated with 10 mg of the drug. Comment on the underlying mechanism and the cause for the same.

16. After a field survey population of orchid species was estimated to be small enough to be categorised as rare. Which strategy of conservation would you adopt ? Justify your choice by mentioning appropriate reasons.

Or

Describe the process of generating monoclonal antibodies.

Or

In a simulated artificial biosphere in a science park, there are ecosystems, a water body and ice caps. Comment on the change in the atmosphere, if :

- (a) the ice caps are made to melt.
(b) the temperature of the waterbody is increased by 3°C.

Or

Both lac O^C and lac *i* mutants show the same phenotype (as constitutive expression of lac operon). How can you differentiate between these two mutants ?

17. How do you explain different outcome of signal transduction events involving common secondary messenger molecules in a specific cell ?

Or

Eighty people who ate shrimp at a dinner developed diarrhoea, cramps, weakness, nausea, chills, headache and fever from 4 hours to 2 days after eating. Indicate whether this is an example of a food infection or intoxication.

Or

What are characteristics of marine aquatic habitat ? How do the plants in aquatic habitat maintain the water balance ?

Or

Two pigs cloned by identical technique using nuclei from the same organ but from different sources were found to have differing life spans. What possible reason can you suggest in keeping with the idea learned from "Dolly" ?

18. A gel pattern displaying PCR products shows 4 strong bands. The four pieces of DNA have lengths that are approximately in the ratio of 1 : 2 : 3 : 4. The largest band is cut out of the gel and PCR is repeated with the same primers. Again a ladder of 4 bands is evident in the gel. What does this reveal about the structure of the encoded protein.

Or

Both haemoglobin and myoglobin bind to oxygen reversibly. Only the binding of oxygen to haemoglobin shows positive cooperativity but not the binding of oxygen to myoglobin. Reason out and suggest the physiological significance.

Or

“Stability of a community is a function of its species diversity. Succession in an ecosystem leads to increase in diversity.” Reason out the facts.

Or

A scientist on a field trip to remote areas of Namibia unearthed a small hominoid bone, which is presumed to be of pleistocene era. Which technique should be used to confirm the geological era and how ?

19. A student has been asked to conduct an experiment to test the performance of 10 (ten) new genotypes in terms of their yield. He set up an experiment in RBD (Randomised Block Design) with 3 replications and collected data on the yield from each of the plots. How will you analyse the data ?

AUG - 34311/III

ROUGH WORK